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(54) Transportable Storage Tanks

(57) A large capacity (e.g. 22,500 litre) storage tank which can be transported from site to site, has the floor (11), wall (12) and roof (13) connected together and reinforced by suitable reinforcing means (16—20) to form a strong, integral unit. Preferably the tank is cast in concrete in one step with at least one integral column (15) connecting its floor and roof. A method of and apparatus for transporting the tank using a lifting frame in conjunction with a tilting frame on a carrying vehicle is also described.

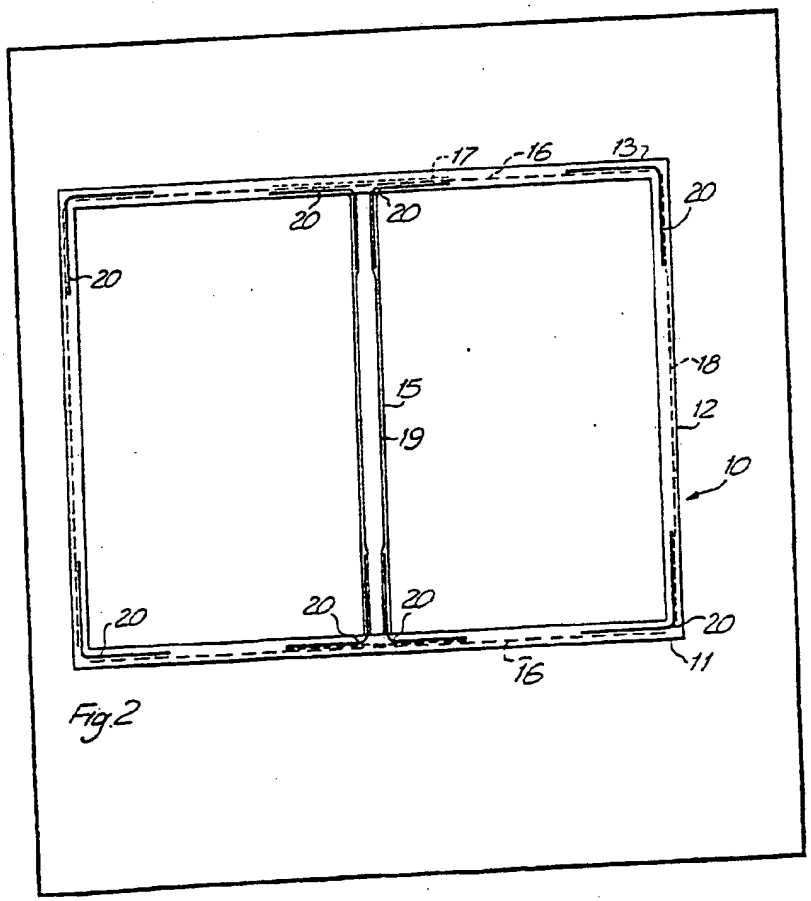

Fig.2

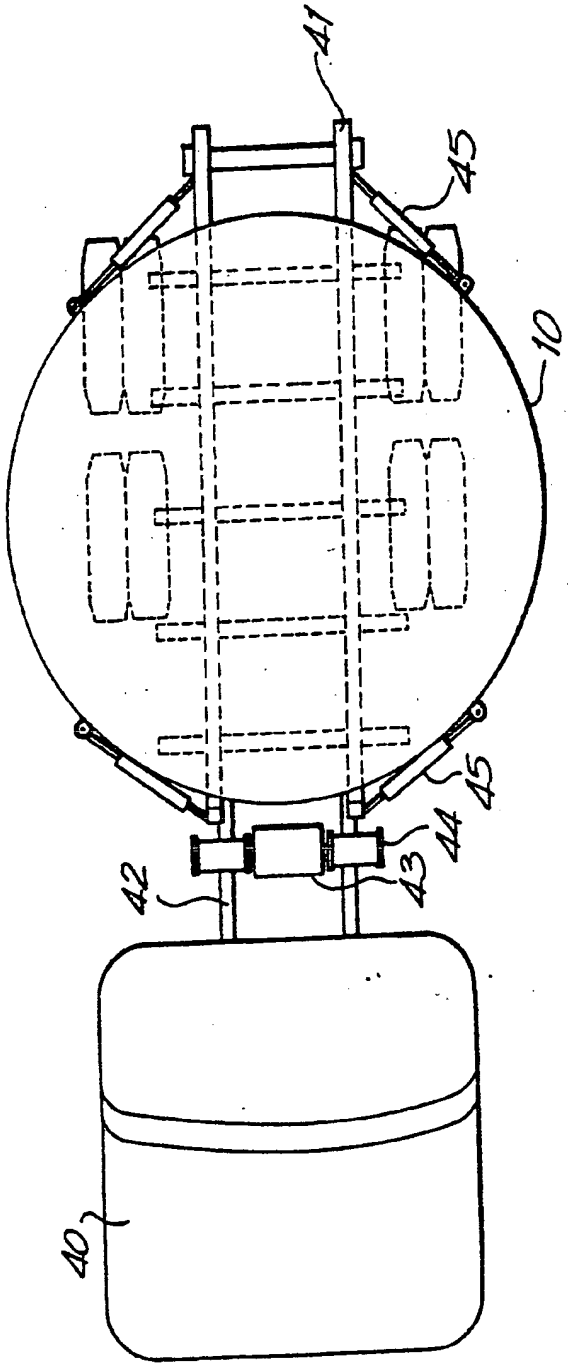

Fig.4

SPECIFICATION

Storage Tank and Transport Means

This invention relates to an improved storage tank, and the method and apparatus for transporting the tank from the factory to the required site. In particular, the invention is related to large capacity storage tanks of 20,000 litres (4,500 gallons) or greater.

Previously, large capacity concrete storage tanks have been constructed in situ. The site is prepared, the reinforcing and formwork is erected and the concrete is poured and the tank walls cured, or the tank is erected in sections. The major disadvantages of this type of in situ constructions are as follows:

Firstly, the tank must be erected on the site and the quality control cannot be maintained to the same strict level as would be possible if erected in the factory.

Secondly, all the equipment necessary for erection must be transported to the site, the tank erected, and then returned to the factory. This is both expensive and time-consuming.

The object of the present invention is to provide a large capacity storage tank, for example of 22,500 litres (5,000 gallon) capacity which may be erected at the factory, transported to and placed on a prepared site.

Small capacity storage tanks and septic tanks, for example of 2,250 to 4,500 litre (500 to 1,000 gallon) capacity are manufactured at the factory, transported to and erected on site, but this has not been possible previously with larger capacity tanks.

A further preferred object of the present invention is to provide a method of transporting the tank, once erected, to the required site.

A further preferred object is to provide apparatus to carry out the above method.

Further preferred objects of the present invention will become apparent from the following description.

In one aspect, the invention resides in a large capacity storage tank including:

a floor, a circular wall and a roof, and reinforcing means passing through and connecting said floor, wall and roof together to form an integral unit, the strength of the tank being such that the tank may be transported from one site to another.

Preferably, the tank is cast in concrete in a single step. Preferably at least one column is cast to integrally connect the floor and roof. Preferably, the tank has lifting lugs cast into the floor.

In a second aspect, the invention provides a method of transporting a large capacity storage tank from one site to another, including the steps of:

lifting the tank, lowering and securely mounting the tank on a lifting frame, lifting the frame onto a vehicle, moving the vehicle from one site to another, lowering the frame from the vehicle, demounting the tank from the frame and positioning the tank on the required site.

Preferably, the lifting frame is lifted onto, and lowered from, the vehicle by means of a tilting frame on the vehicle.

Preferably, movement of the lifting frame on the tilting frame is erected and controlled by a winch and cable (or chain) mounted on the tilting frame.

In a further aspect, the invention resides in apparatus for transporting the storage tank, said apparatus including:

a vehicle,

a tilting frame on said vehicle,

a lifting frame adapted to be releasably mounted on said tilting frame,

said tilting frame being adapted, when tilted, to allow the lifting frame to be moved along said tilting frame and lifted from the ground onto the vehicle and vice versa.

Preferably, the tilting frame is provided with a winch and cable (or chain) to move the lifting frame along the tilting frame.

Preferably, means are provided to secure the lifting frame and the tank to the vehicle during transportation.

To enable the invention to be more fully understood, a preferred embodiment will now be described with reference to the accompanying drawings, in which:

Fig. 1 shows a top view of the tank;

Fig. 2 is a section view taken along line A—A in Fig. 1;

Fig. 3 is a side view showing the tank and lifting frame being loaded onto a vehicle (dashed lines) and loaded on the vehicle (full lines); and

Fig. 4 shows a top view of the tank on the vehicle in the transport mode.

Referring to Figs. 1 and 2, tank 10 has a floor slab 11, a circular outer wall 12 and a roof 13 all cast of concrete. A circular manhole 14 is cast into the roof 13 to allow access to the interior of the tank.

Referring to Fig. 2, the circular outer wall 12 is tapered in cross-section, the thickness of the wall decreasing up the wall.

A support column 15 is centred on the tank and is formed by concrete filled PVC pipe, the pipe forming a non-removable formwork for the pouring of the concrete.

Reinforcing steel is provided in the wall, floor, slab, roof and column to give the tank greater strength.

The floor slab 11 and roof 13 each have circular, planar reinforcing mesh sheets 16, with an additional reinforcing sheet 17 centred on the sheet 16.

Outer wall 12 has a reinforcing mesh sheet 18 embedded therein around the full circumference of the wall.

Column 15 has substantially parallel reinforcing rods 19 extending the full length of the column.

At the junction of the roof to the wall, the floor slab to the wall, the column to the roof and the column to the floor slab, additional reinforcing rods 20, bent to an L-shape, are cast in position to

securely tie the various components together.

Lifting lugs 21 are cast into the floor slab, spaced circumferentially around the latter, for the purpose to be described later.

Referring now to Figs. 3 and 4, a substantially square lifting frame 30 has a roller 31 rotatably mounted across the rear side adapted to engage the ground, and an upstanding frame 32 across the front of the lifting frame 30. Skid members 33 are welded to the underside of the lifting frame.

Vehicle 40 is fitted with a tilting frame 41 hingedly mounted to the rear of the vehicle chassis 42. A roller 41A is provided transversely of the rear of the tilting frame 41.

Hydraulic rams (not shown) connected to the tilting frame 41 and chassis 42 are arranged to lift the front end of the tilting frame so that the latter may be lifted to an angle of approximately 30° to the horizontal.

A winch 43, with a pair of cable drums 44, is mounted transversely of the front end of the tilting frame 41. The cables wound on the drums are provided with hooks which can be connected to the front end of the lifting frame 30.

When the lifting frame 30 has been positioned on the tilting frame 41 for transport, the two frames are securely connected by means of chains with turnbuckles 45 (see Fig. 4).

The method of transporting the tank will now be described.

After the tank has been cast, cured and is ready for transportation from the factory to the site, the tank 10 is lifted by a crane, using an arrangement of cables and hooks (the latter engaging the lifting lugs 21 in the floor slab 11) and lowered into position onto the lifting frame 30 to which the tank 10 is secured.

The vehicle 40 is reversed to a position adjacent the lifting frame 30. The hydraulic cylinders are extended and the tilting frame 41 is raised to the position shown by the dashed lines in Fig. 3.

The cables are played out from the drums 44 and their respective hooks are attached to the front of the lifting frame.

The winch 43 is operated to draw the lifting frame 30 towards the vehicle. The front of the lifting frame 30 engages the roller 41A on the tilting frame 41 and the lifting frame 30 is then drawn up along the tilting frame in the manner shown in the dashed lines in Fig. 3, the roller 31 supporting the rear end of the lifting frame.

When the lifting frame is fully engaged on the tilting frame, the latter is lowered to the position shown in the full lines in Fig. 3. The lifting frame is then secured to the vehicle by means of the chains and turnbuckles 45.

On the site, the tank is unloaded by reversing the procedure described, the winch 43 being used to control the descent of the lifting frame 30 down the inclined tilting frame 41.

The tank is lifted off the lifting frame 30 by means of a crane and placed on the previously prepared site.

Tanks of the type described and illustrated by the preferred embodiment have a number of advantages over known tanks, including:

(1) they can be easily transported from site to site, using equipment of the type described and illustrated;

(2) by selecting a suitable lining material e.g. beeswax, bitumen, the tanks can be used for a wide range of applications including water storage, storage of pollution products such as used oil, and chemicals;

(3) as the tank is manufactured in the factory under controlled conditions, a higher and more consistent standard of quality control is available and can be maintained over tanks manufactured in situ;

(4) the tank is particularly suitable for underdeveloped countries which do not have the necessary facilities to manufacture the tanks in situ. In addition, the only site work required is preparation of the foundations which can be done, albeit slowly, by manual labour with simple tools if suitable earthmoving equipment is not available;

(5) practical testing has shown that the permissible loading on the roof may be in the order of 16 tonnes (15.7 tons). Where the tank is provided underground or with its roof at ground level, no additional reinforcing of the roof is required to allow vehicles to drive over it. In above ground installation, a smaller 4,500 litre (1,000 gallon) tank may be installed on top of the tank, again without additional reinforcing being required.

Various changes and modifications may be made to the embodiment described without departing from the scope of the present invention.

Claims

1. A large capacity storage tank including:
a floor,
a circular wall,
a roof, and
reinforcing means passing through and connecting said floor, wall and roof together to form an integral unit, the strength of the tank being such that the tank may be transported from site to site.

2. A tank as claimed in Claim 1 and further including:
at least one column integrally connects the floor and the roof.

3. A tank as claimed in Claim 1 or Claim 2 wherein:
the tank is cast in concrete in a single step; and
lifting lugs are cast into the floor.

4. A large capacity storage tank substantially as hereinbefore described with reference to Figs. 1 to 4 of the accompanying drawings.

5. A method of transporting the tank as claimed in any one of Claims 1 to 4 from one site to another site, including the steps of:
lifting the tank;
lowering the tank and securely mounting it on a lifting frame;
lifting the frame onto a vehicle;

moving the vehicle from one site to another site;

lowering the frame from the vehicle;

demounting the tank from the frame; and

positioning the tank.

6. A method as claimed in Claim 5 wherein:

the lifting frame is lifted onto, and lowered from, the vehicle by means of a tilting frame on the vehicle, the movement of the lifting frame being controlled by a winch mounted on the tilting frame.

7. A method of transporting a large capacity storage tank from one site to another site substantially as hereinbefore described with reference to Figs. 3 and 4 of the accompanying drawings.

8. Apparatus for transporting the storage tank, as claimed in any one of Claims 1 to 4, said apparatus including:

a vehicle;

a tilting frame on said vehicle;

a lifting frame adapted to [illegible] mounted on said tilting frame;

said tilting frame being adapted, when tilted, to allow the lifting frame to be moved along said tilting frame and lifted from the ground onto the vehicle and vice-versa.

9. Apparatus as claimed in Claim 8 wherein:

the tilting frame is provided with a winch and cable to move the lifting frame along the tilting frame.

10. Apparatus as claimed in Claim 8 or Claim 9 and further including:

first releasable means to secure the lifting frame to the vehicle; and

second releasable means to secure the tank to the lifting frame.

11. Apparatus for transporting a large capacity storage tank from one site to another site substantially as hereinbefore described with reference to Figs. 3 and 4 of the accompanying drawings.

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